

Evans Water and Sewer Board

Evans Community Complex
Council Chambers
1100 37th Street, Evans, Colorado

Time and Date: August 20, 2020 @ 3:30 p.m.

1. ROLL CALL

Chairman: Jeff Oyler
Vice-Chairman: Glenn Snyder
Commissioners: Randy Blewer
Brett Bloom
Michael Thuener

Ex-Officio Members:

Mayor: Brian Rudy
City Manager: Jim Becklenberg

City Staff:

Randy Ready, Public Works Director
Mark Oberschmidt, City Engineer
Robby Porsch, Wastewater Superintendent
Karen Sabin, Public Works Administrative Specialist

2. APPROVAL OF MINUTES

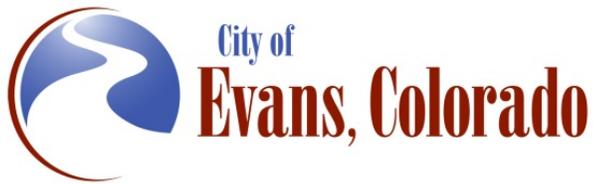
Approval of minutes from 07.16.2020 regular board meeting

3. POTABLE, NON-POTABLE, AND STORMWATER UPDATES

- a. Eastside Storm Sewer (Mark Oberschmidt)
- b. Tuscany Tract O (Mark Oberschmidt)

5. WASTEWATER UPDATES

- a. Lagoon Decommissioning (Mark Oberschmidt)
- b. Wastewater Treatment Plant capacity review – population, load, and flow projections (Randy Ready and Robby Porsch)



Evans Water and Sewer Board

Evans Community Complex
Council Chambers
1100 37th Street, Evans, Colorado

Time and Date: July 16, 2020 @ 3:30 p.m.

1. ROLL CALL – 03:38 pm

Chairman: Jeff Oyler
Vice-Chairman:
Commissioners: Randy Blewer
Glenn Snyder
Ex-Officio Members:
Mayor: Brian Rudy
City Manager: Jim Becklenberg

City Staff:

Randy Ready, Public Works Director
Rick Pickard, Senior Civil Engineer
Mark Oberschmidt, City Engineer
Robby Porsch, Wastewater Superintendent
Karen Sabin, Public Works Administrative Support

2. APPROVAL OF MINUTES – 03:57 pm

Approval of minutes from 05.21.2020 regular board meeting
****Motion to approve/second. Passes unanimously.**

3. AGENDA ITEMS – 03:58 pm

A. Municipal Water Efficiency Plan Approval and Recommendation (Rick Pickard)
WEP is a requirement of the water conservation act as well as CRS. Required to be updated approximately every seven years. Current Plan is dated 2009, so it's been ten years – the one we are bringing forward is the 2019 Plan. We were able to secure a \$30k grant to help with the costs of the Plan, so we contracted with Clearwater Solutions to complete update.

Describes major components in the WEP (see staff memo for details). Plan will be a guide for City staff regarding water conservation for years to come. The City's ultimate goal is to get the Plan approved by the state, but there are several steps to get to that stage. W&S Board recommendation for approval by City Council is first, then to City Council, then it will be open for the public to comment on. Possible revisions after that, depending what feedback the public gives.

If City has an approved WEP in place, the City will qualify for funding from a couple of great agencies that we can use for other water services.

****I move that the draft Municipal Water Efficiency Plan be forwarded to City Council with a recommendation for approval/Second. Passes unanimously.**

4. POTABLE, NON-POTABLE, AND STORMWATER UPDATES

- a. Review and discussion of the draft water conservation section of the Master Plan. (Rick Pickard) – **04:04 pm**

As part of the Comprehensive Plan, we received a grant from the Sonoran Institute to integrate our water conservation plan measures into the Water section of the City's Comprehensive Plan. Water efficient public spaces, water-efficient changes to landscaping standards of the City, increased use of non-potable water, etc.

- b. 17th Avenue Waterline (Rick Pickard) – **03:39 pm**

This project should be completed by tomorrow—ahead of schedule and on budget. Should be wrapped up this Friday or Monday. We've walked through it already and it looks good. Global Underground did a good job. There are two remaining water services to hook up, then a final punch list. We only had one complaint on how City restored one person's yard. We did some more work and resident was happy.

- c. Eastside Storm Sewer (Mark Oberschmidt) – **03:42 pm**

City got good news today. We've been talking to CDOT about storm sewer that we were going to tunnel under US 85 to install, but soil engineers determined the soil would be difficult to drill through – overall it's risky project, especially given the size and depth of the pipe. We asked CDOT about a month ago if we could open cut the project and divert traffic. They had a few questions about traffic and how we were going to deal with soils. Today we got email from CDOT to proceed with design on an open cut process. This will save the City a lot of money and time. City will work with CDOT on staging and traffic flow.

31st Street: The City is working on design for a detention pond and installing some additional inlets on the east side of 85. Along with that work, some of the storm sewer east of 85 is full of dirt and needs to be cleaned out. Hydro-vacuuming involves getting permission from Union Pacific to work under the railroad. We are trying to get a maintenance permit from them (which is free), but they want to say the work is higher level than maintenance and charge us a pretty substantial permit fee. Once we get that sorted out with them, we need to clean out the line and camera it to see what the quality of the pipe is. Hopefully the pipe itself is not in terrible condition. We are bringing in a third-party estimator for this job to check the final cost estimate from BT Construction. If their estimate is 5% or more lower than the bid, we will start looking at details we can negotiate. It might save us some money.

Question: Where's the big pipe going to go? Answer: From Heritage Inn underneath the highway past 1st Avenue and then daylight it to the river.

- d. Tuscany Tract O (Mark Oberschmidt) – **03:49 pm**

Irrigation and pump station design is completed, but the pump station is a long lead time item – 12 to 18 weeks. So we broke that out as a procurement bid, which will cut down on that lead time. We had estimated the pump station would be a quarter

million dollars, but the bids came in lower than that. Once Tract O is surveyed we'll start on grading and fixing structures, and installation of pump station. Plans should be completed by the end of August so we can put it out to bid by September. This is work that can mostly be done over the winter so that's what we'll work toward.

e. Willowbrook (Randy Ready) – **03:52 pm**

This purchase is going back to City Council again. The City negotiated a \$1.5 million purchase price that was supposed to be payable over three years. After review of finances, Finance Director is recommending a one-time payment.

f. Water distribution staffing (Randy Ready) – **03:54 pm**

Our water foreman, Doug Henry, has announced his retirement. He's worked for the City for 29 years. He will be doing a lot of cross-training over the 90 days between his notice and his retirement. Looking at Willowbrook nonpotable distribution system and the Peakview development coming over the next few days, the City will need to think about what water staffing looks like.

Question: Is there anyone on staff already who can take that over? Answer: We have one person on staff who has a lot of experience with water work, but he has let the City know he only has several years of work left and does not want any supervisory responsibilities.

City Comment: We have gotten a lot of our system into GIS over the years, which will help us transition to new staff without losing a lot of system knowledge.

5. WASTEWATER UPDATES

a. Lagoon Decommissioning (Mark Oberschmidt) – **04:06 pm**

Plans are progressing for decommissioning of lagoon. Once that is done, we can put the east side storm sewer through there. We can also reconfigure the lift station and use the pond there as a backup for the City. The material that we remove from the pond, we will try to reuse right there on the property. Our goal is to submit the plans to CDPHE in September.

Question: Is the building going to stay out there? Answer: The lift station will stay in place and the office building will stay in place. We're taking out the berm along first avenue to shape the ground.

b. Wastewater Treatment Plant capacity review – population and flow (Randy Ready and Robby Porsch) – **04:10 pm**

A capacity study has been underway since December of last year with Dewberry. Our first year review came back with glowing comments about efficiency. However, the organic loading on the plant is high. The second part of the work has to do with making some projections for population, flow, and load looking ahead 20 years so

that we can make best estimates for future expansion. Dewberry's projections are tied to population figures and flow and load figures rather than a timeline. That works well for the city because population growth is what will bring in the fees that will help us fund the facility changes we need. The report should be done October/November of this year and we will bring it back to you then.

c. Lagoon Dewatering (Robby Porsch) -- **04:13 pm**

City renewed our contract with Veris – they offered us the same price as in their 2019 contract. We ran into some urgency in needing to take down the west pond. In 2019, Veris caused damage to the pond liner that was causing all sorts of off-gassing and bubbling problems as leakage got underneath the liner and into the soil. It was quite a process. We had to shut down the Evans Ditch, dewater the pond, remove the bottom of the damaged liner, remove the solids from underneath the liner, replace the liner, and then start using the pond again.

City Question: How old was the pond liner? Answer: Many years. It was time for it to be replaced anyway.

Question: Is the Evans Ditch running again? Answer: Yes.

Question: How is the odor problem? Answer: That pond was a major source of the odor problems. It's way better now.

City Comment: We would like to echo Staff's gratitude to Robby and his crew. Of course, as luck would have it, this work had to be done during the hottest days of the year. It was really hot and miserable, but they did excellent work.

04:19 pm: Jeff Oyler nominates Glenn Snyder as vice-chair.

****Motion for Glenn Snyder to serve as vice-chair/Second. Passes unanimously.**

City Comment: Michael Teener, Planning Commission applicant would be a good fit for this board.

City Question: Could the board possibly do interviews before next month's meeting at a special meeting? Since the Board is down two members now, it would be good to get people appointed so business can continue. Response: Board members are fine with that.

City Comment: Next Tuesday, 07.21.2020, City Council will be honoring Jim Krenzel. Meeting starts at 7:00 pm. He would probably appreciate your presence there if you can make it.

04:24 pm: ****Motion to adjourn/Second. Passes unanimously.**

CITY COUNCIL WORK SESSION REPORT

DATE: August 3, 2020

AGENDA ITEM:

SUBJECT: Wastewater Treatment Plant Capacity Study: Population and Flow Projections

NAME & TITLE: James L. Becklenberg, City Manager
Randy Ready, Asst. City Manager
Robby Porsch, Wastewater Superintendent

ISSUE DESCRIPTION:

The attached technical memorandum and this work session presentation and discussion will focus on the 20-year (2040) projected wastewater flow and load from new population growth projections and recommended next steps for City Council's consideration.

At the December 17, 2019 City Council work session, staff and the consultants from Dewberry Engineering presented the results of a review of plant operations and capacity that indicated that the plant is operating well. However, 18 months into its operation, the plant has reached about 80% of its design capacity for influent organic loading. There are multiple factors contributing to the capacity issues, including population growth that has occurred faster than projected and a greater concentration of organic compounds than expected for the current population as measured by 5-day biochemical oxygen demand (referred to as BOD5 throughout the report).

With regard to the original population projections, the plant's design capacity was based on 2010 Census data indicating 18,537 people in Evans at that time. The best-available information about population growth rates leading into the plant design resulted in a forecast of 2% growth in the Hill-N-Park basin (mostly west of 35th Avenue) and a 0.5% growth projection for the Evans Basin (east of 35th Avenue). The cumulative effect of those two growth assumptions led to a range of growth per year of 1.15% to 1.28% over the 20-year planning horizon. The population was projected to increase overall by 35% from 2010 to 2035, with Evans growing from 18,537 to 25,053 during that time. A population of 25,053 became the design capacity target for the plant.

However, since Evans emerged from the slow growth period during the recession and the early years of the 2010s, actual growth has surpassed projections. While the results of the 2020 Census will provide a more accurate update of population, there are indications that the current (2020) population served by the plant is approaching 23,000. That level of population was not expected until 2028 under the earlier projections. In addition, based on the number of homes in developments that have been approved and are in the construction pipeline over the next five years, Evans is expected to grow by about 6% per year between 2020 and 2024.

The 7,937 current sewer taps multiplied by a rough average of 2.9 residents (household size) per tap leads to an estimated 2019 population of about 23,000. Adding the anticipated growth

between now and 2024 would result in a population of about 28,000 by that time. Similarly, a demographic analysis published in 2018 for the City of Evans estimated a population of 21,349 in 2017, growing by an average of 2.71% per year to 22,500 in 2019, and over 26,000 by 2024. A third analysis based on the use of building permit data to calculate that the 950 residential units of growth between 2014 and 2019 would yield similar results with an estimated population over 22,000 in 2019.

One other factor complicating future growth projections was an increase in the average household size in Evans over time. The 2013 Wastewater Utility Plan population estimates were based on an average household size of 2.5 occupants. Current estimates by both the U.S. Census Bureau and DOLA show the average number of persons per household in Evans to be 2.9 to 3.0.

The first report and presentation pointed out other anomalies in the current wastewater flows and BOD5 loading data that need further research in order to understand and act upon. The current flow per capita is lower than expected and the current organic loading per capita is significantly higher than both historic numbers and the data from similar communities.

Based on the cumulative WWTP service area population in 2020 of 22,437, including people in some unincorporated portions of Weld County adjacent to Evans and temporarily including the St. Michael's subdivision in Greeley, the 20-year planning population for the Year 2040 grows to 38,323 people. During the work session presentation staff will discuss the resulting flow and load projections of that level of population. The population growth figures are based on the best-available data and projections from the U.S. Census Bureau, the State Department of Local Affairs and Weld County. Evans is expected to grow by an annual average growth rate of 3.04 percent per year and Weld County is expected to grow by a similar 3.05 average annual growth rate, resulting in cumulative growth of about 70 percent over the twenty years.

The current plant has insufficient capacity to handle the projected growth in flow and organic solids load. The findings of the projections regarding population, flow, and organic load lead to the next step for council's consideration to evaluate WWTP capacity expansion alternatives that will accommodate the wastewater flows and loads anticipated over the next twenty years as a result of projected population growth. The Plant Expansion Alternatives Analysis will look into both process intensification and plant expansion.

Staff and the consultants will return to Council later this year with a description of the alternatives along with the operating and capital costs and life-cycle considerations of the various alternatives. Triggers for incremental plant expansion will be based on the WWTP reaching certain increased flow and load levels, NOT on certain dates. In that manner, population growth will help to pay its own way toward the cost of WWTP expansion.

FINANCIAL SUMMARY:

It is difficult to estimate and compare the financial impacts of various treatment plant capacity increase alternatives without proceeding with the next step: A Plant Expansion Alternatives Analysis. The purpose of that analysis will be to explore available technologies and estimate their capital and operating costs over an extended period. Both process intensification technologies and plant infrastructure expansion alternatives will be considered, with the results of that analysis to be delivered to City Council for further discussion within the next few months.

REQUESTING FROM CITY COUNCIL:

Feedback and questions pertaining to the WWTP Population and Flow Projections. Direction to proceed with the projections being used for the analysis.

ATTACHMENTS:

- WWTP Population, Flow and Loading Projections

Date: May 26, 2020

To: City of Evans

From: Patrick Radabaugh, PE and Allie Beikmann, PE - Dewberry Engineers

Subject: City of Evans WWTP - Population, Flow, and Loading Projections

EXECUTIVE SUMMARY

The City of Evans Consolidated Wastewater Treatment Plant (WWTP) was constructed in 2018 and recent plant operations data from 2019 shows the WWTP is operating at approximately 60 percent of hydraulic capacity and almost 80 percent of organic capacity. The average day (AAF), maximum month (MMF), and peak day flow rates for 2019 were 1.65 MGD, 1.81 MGD, and 2.08 MGD, respectively. The average day and maximum month organic BOD₅ loading rates for 2019 were 4,629 ppd and 5,224 ppd, respectively. This max month loading rate is at 79% of the design capacity for the WWTP. At 80 percent treatment capacity, the EPA and CDPHE state the permittee is required to initiate engineering and financial planning for expansion of the domestic wastewater treatment works. The current wastewater flows and loads were not projected to occur until approximately year 2028, but greater than anticipated population growth has occurred in the City which resulted in faster use of the available wastewater treatment capacity. The goal of this technical memorandum is to document the impacts from new 20-year projected wastewater flow and load from new population growth projections on the existing WWTP infrastructure. A future technical memorandum will evaluate alternatives to accommodate the new 20-year planning horizon wastewater flows and loads developed as part of this technical memorandum.

The City of Evans Consolidated WWTP served an estimated 21,133 people in 2018. City of Evans population projections were developed utilizing the current population and growth rates of 3.04 percent and 3.05 percent for the City and Weld County, respectively. The 20-year planning population for Year 2040 for the Consolidated WWTP is 38,323 people. This corresponds to projected flow rates of 3.4 (AAF), 4.1 (MMF), and 8.6 MGD (peak hourly flow, PHF) and projected max month BOD₅ loading is 11,930 pounds per day (ppd).

Most unit processes at the plant will need to be upgraded to accommodate the 2040 projected wastewater flow and BOD₅ load. A succeeding memorandum will be provided to recommend individual process updates based on the outcomes of this evaluation. The following is a summary of the projected, recommended improvements to the liquid stream and solids handling processes. Costs and alternatives analysis will be performed in a future technical memorandum.

1. Headworks

- a. Mechanical Screening: Insufficient hydraulic capacity to accommodate projected 2040 PHF. Add a second mechanical screen to available channel.
- b. Grit Screening: Insufficient hydraulic capacity to accommodate projected 2040 PHF. Add a second grit screening and washing process north of GCC 1201.

- c. Lift Station: Insufficient hydraulic capacity to accommodate projected 2040 PHF. Increase capacity by adding a third wet well chamber and upgrading pump operation to 6 pumps (5 duty, 1 standby) to meet 9 MGD.
 2. Secondary Process
 - a. Johannesburg Process: Insufficient treatment capacity 2040 BOD₅ and ammonia loads. Will need to increase secondary process treatment capacity by adding additional Johannesburg process trains or incorporating Biomag (a process intensification process)
 - b. Secondary Process Pump Station:
 - i. Process Pumps (RAS, WAS) – Insufficient capacity to meet 2040 flows. Incorporate additional process pumps and/or building space to accommodate future secondary process requirements.
 - ii. Blowers – Insufficient capacity to meet projected 2040 loads. Incorporate additional blower in the available space.
 - iii. Construct new scum pump station. Scum currently flows by gravity to the anaerobic sludge lagoons
 - c. Secondary Clarifiers – Insufficient capacity to meet projected 2040 flows and loads. Either incorporate additional secondary clarifiers or upgrade to Biomag (process intensification process).
 3. Disinfection and Effluent System
 - a. UV Disinfection Insufficient hydraulic capacity to accommodate 2040 flows. Add modules to channel UVG 7003.
 4. Solids Handling – Anaerobic sludge lagoons have insufficient capacity to accommodate 2040 loads.
 - a. Incorporate WAS thickening and biosolids dewatering.
 - b. Incorporate aerobic digestion or ATAD (AutoThermal Thermophilic Aerobic Digestion).

WWTP DESIGN: POPULATION PROJECTIONS, REVISITED

The City of Evans experienced a growth in population in the last few years that well exceeded the population estimates utilized in the initial planning of the Consolidated WWTP. A direct result of the growth is that the WWTP is currently operating near 80 percent organic capacity. At 80 percent capacity, the EPA and CDPHE recommend the facility initiate planning efforts to upgrade the facility to treat additional flows and loads.

The WWTP primarily serves residential, commercial, and industrial units in Evans proper, but also serves some additional residents in Greeley and unincorporated Weld County. A total of 7,188 dwelling units were estimated to be served by the plant in 2018: 6,090 dwelling units in the City of Evans, 657 units in unincorporated Weld County, and 441 units in Greeley. Based on historical City data, approximately 2.94

persons per dwelling unit is a good estimate for calculating population. This yields an estimated 2018 population of 21,133 people served by the plant. A summary of the current service area information is provided in **Table 1**.

Table 1 – Residential Population Served by the Evans WWTP in 2018

Item	City of Evans	Weld County	Greeley	Cumulative
Dwelling Units ¹	6,090	657	441	7,188
Population per Unit ²	2.94	2.94	2.94	-
Population	17,905	1,932	1,297	21,133

¹ Number of dwelling units served by the Evans WWTP are from the City of Evans and Greeley City of Evans is based on correspondence with Greeley. Back-calculated to get Weld DUs.

² Population per unit obtained from City of Evans' estimates. Used this value for Weld and Greeley.

During the WWTP planning phase in 2014, the population of Evans was projected to increase from 19,865 to 25,053 over a 20-year planning horizon of the project (2016 to 2035) which corresponds to an annual growth rate of 1.23 percent. The actual population growth rate was more than two percent. Refer to **Table 2** for the annual growth rates from 2015 to 2018, from the US Census Bureau.

Table 2 – Weld County, Annual Growth Rate 2015 through 2018 (U.S Census Bureau)

Year	Growth Rate
2015	2.2%
2016	2.6%
2017	2.8%
2018	3.3%

For the next 20 years, the City is projecting an average annual population growth of 3.04 percent within the City limits and 3.05 percent outside the City but within the service area. Additionally, the City estimates that in five years, the St. Michael's area will be served by Greeley's wastewater infrastructure following construction of a local lift station, thus the wastewater from these residents will no longer be collected and treated by the City's infrastructure. Refer to **Table 3** for population projections for 2020 through 2040.

Table 3 – Population Projections, Year 2020 through 2040

Year	City of Evans	Weld County	Greeley	Cumulative
2020	19,009	2,051	1,377	22,437
2025	22,077	2,383	1,600	26,060
2030	25,640	2,769	N/A	28,409
2035	29,778	3,217	N/A	32,996
2040	34,584	3,738	N/A	38,323

2019 OPERATIONS DATA

Influent data from 2019 is presented in **Table 4** and **Table 5**. Operations staff at the WWTP take influent BOD₅ and TSS measurements approximately three times per week and influent ammonia and phosphorus readings approximately once a week. Average and max month 2019 BOD₅ loadings were 4,628 and 5,224 ppd, respectively, while average day influent flow was 1.66 MGD and max month flow was 1.81 MGD. The 2019 service area population is 21,775 people.

Table 4 – Average and Max Month Flow and Load Summary for Year 2019

Parameter	AA	MM
Flow, MGD	1.65	1.81
BOD ₅ , ppd	4,629	5,224
TSS, ppd	3,424	4,098
NH ₃ , ppd	556	599
Total P, ppd	91	105

The 2019 average influent BOD₅ is approximately 336 mg/L. This is higher than the average of 293 mg/L during 2005-2014, and higher than the WWTP design values of 259 mg/L average and 320 mg/L max month (Dewberry, 2015). The average influent concentrations for ammonia and Total P are 40.4 mg/L and 6.6 mg/L, respectively.

Table 5 – Influent Concentrations Summary for Year 2019, mg/L

Parameter	AA	MM
BOD ₅	336	379
TSS	248	297
NH ₃	40.4	43.5
Total P	6.6	7.6

PROJECTION RATIONAL AND ASSUMPTIONS

Based on 21,775 residents served in 2019, the average day per capita flow rate is 75.8 gallons per capita per day (gpcd). Refer to **Table 6** for the per capita flow and loading rates (pounds per capita per day – ppd) for Year 2019.

Table 6 – Per Capita Flow and Loading Rates for Year 2019 and Selected Rates for Projections, gpcd and ppd

Parameter	2019 Average Day	Selected Rate for Projections
Flow Rate (gpcd)	75.8	75.8
BOD ₅	0.21	0.21
TSS	0.16	0.19
NH ₃	0.026	0.026
Total P	0.0042	0.0042

The average day values are used in the follow sections for projected flow and loading rates. By comparison to historical data, the BOD₅ rate is slightly higher than what was observed between 2005 and 2014, which was 0.19. However, it falls in the typical range.

The estimated loading rate for TSS was 0.16 ppd per capita for the year 2019, which is at the extreme low range when compared to the 2005-2014 data. The average for this period was 0.19, with a range of 0.16 to 0.24 annually (Dewberry, 2015, pp. Table 4-22). Since this year of data may be an outlier for typical solids content, 0.19 will be used for flow and loading projections.

During development of the WWTP assessment, measurements of ammonia were not taken at either WWTP, thus historical data is only available for Year 2019. Typical values for ammonia are between 0.011 and 0.026, thus the ammonia measured is at the high end of the spectrum (Metcalf & Eddy, Inc., 2003). Although it is currently unknown if the year 2019 was a high year for ammonia or typical of the wastewater, the 46 samples taken throughout the year is the best available data, thus, 0.026 ppd will be used for projections.

Finally, for the same reasoning provided for the ammonia loads, a per capita loading rate of 0.0042 will be used for total phosphorus.

PEAKING FACTOR (PF) EVALUATION

To determine whether the existing treatment processes were sufficiently sized for future use, peaking factors for the maximum month and peak hourly conditions were evaluated. As is standard practice for CDPHE evaluation, the maximum month peaking factor was determined for the flow rate and the following loads: 5-day biological oxygen demand (BOD₅), soluble ammonia (NH₃), total suspended solids (TSS), and total phosphorus (total P). And in addition, a peak hourly peaking factor was determined for influent flow rate.

Maximum Month

Flow and loading data from 2019 yielded peaking factors (PFs) that were lower than historical values. To account for the short period of data, the selected PFs for all design criteria are the 99th percentile values determined from 2005 to 2014 data. Note that there was no previous data to compare 2018 phosphorus (Total P) measurements to, thus since phosphorus is a sparse nutrient that shows up in similar, relative loadings as ammonia, a value of 1.35 was selected. Refer to **Table 7** for a summary of the maximum month peaking factors for flow and loading rates.

Table 7 – Per Capita Loading Rates for Year 2019, gpcd and ppd

Parameter	AA	MM	2019 MM Peaking Factor	Historical 99 th Percentile
Flow Rate (gpcd)	75.8	83.0	1.09	1.19
BOD ₅	0.21	0.24	1.13	1.24
TSS	0.16	0.19	1.20	1.24
NH ₃	0.026	0.028	1.08	1.35
Total P	0.0042	0.0048	1.15	1.35

Peak Hourly

The peak hourly flow PF is calculated using Figure 3.1 from CDPHE Regulation WPC-DR-1 (2012). Based on the estimated population for 2020 of 22,437, the estimated peak hourly flow PF is 2.6. The lowest limit of the peak hourly PF is 2.5, which is only slightly less than the estimated PF for 2020. To simplify estimates and add a small degree of conservatism, 2.6 was used as the peak hourly peaking factor for all future flow rate scenarios.

INDUSTRIAL AND COMMERCIAL FLOWS

Although the City has few existing industrial and commercial users connected to the wastewater collection system, there is a possibility of future users moving in within the next twenty (20) years. This potential increase in required wastewater treatment system capacity has a moderately high degree of uncertainty and was discussed between Dewberry and City personnel. It was decided that future industrial/commercial wastewater contribution would be 20 percent of the City's residential wastewater flow and load. Thus, for flow and mass loading rates, the projected populations were multiplied by x 1.2 before calculating final quantities. See **Table 8** for an example of how projected flow and loading estimates for 2020 through 2040 consider the addition of industrial and commercial users.

Table 8 – Example: Average Day Influent Flows and Loads For 2019, Adjusted for Industrial/Commercial Inputs

Parameter	Residential	Industrial/ Commercial	Total
Flow Rate (MGD)	1.65	0.28	1.9
BOD ₅ (ppd)	4,629	784	5,414
TSS (ppd)	3,424	580	4,004
NH ₃ (ppd)	556	94	651
Total P (ppd)	91	15	107

PROJECTED FLOW AND LOADING RATES

Projected influent flow and loading rates going to the Consolidated WWTP were estimated for years 2020 through 2040. The current permitted capacity of the Consolidated WWTP is 2.88 mgd and 6,624 ppd BOD₅, respectively.

FLOW RATES

Projected flow rates indicate an average day flow of 3.4 MGD, a max month flow of 4.08 MGD, and a peak hourly flow of 8.58 MGD for Year 2040. The peak hourly flow is an important factor in design capacity for wastewater treatment processes and the 2040 projection numbers are compared to existing design capacity in a later section. With these hydraulic projections, the plant will exceed the permitted hydraulic capacity in approximately Year 2026. Based upon these projections and the EPA/CDPHE requirement that construction of improvements to expand capacity should begin when the WWTP is at 95 percent of (current) capacity, the new improvements are projected to be recommended to be online in

2024. If the 20 percent commercial and industrial contribution is not included, the new improvements are not projected to be online until 2034.

Table 9 – Projected Flow Rates for 2020 through 2040 (MGD)

Year	AAF	MMF	PHF
2020	2.0	2.37	5.18
2025	2.3	2.75	5.87
2030	2.5	3.03	6.36
2035	3.0	3.52	7.39
2040	3.4	4.08	8.58

LOADING RATES

Loading rates are projected through 2040 for BOD₅, TSS, ammonia (NH₃), and total phosphorus (total P). Projected BOD₅ loading for 2040 is 11,926 ppd which is compared to the existing design capacity (6,624 ppd) for the secondary process and process air flow in the next section. With these new projections, the organic loading capacity of the existing WWTP will be exceeded in 2020. Note this value includes the 20 percent industrial/commercial contribution for the City of Evans to accommodate potential growth in this sector, as discussed in the previous section. Assuming no changes to this sector, the organic capacity of the WWTP will not be exceeded until approximately Year 2026, and the 95 percent level for start of construction occurs in year 2024-25.

Table 10 – Projected Loading Rates for 2020 through 2040 (ppd)

Year	BOD ₅		TSS		NH ₃		Total P	
	AA	MM	AA	MM	AA	MM	AA	MM
2020	5,578	6,917	4,985	6,182	670	905	110	149
2025	6,479	8,034	5,790	7,180	779	1,051	128	173
2030	7,130	8,841	6,372	7,901	857	1,157	141	190
2035	8,281	10,268	7,401	9,177	995	1,344	164	221
2040	9,618	11,926	8,596	10,658	1,156	1,561	190	256

The summarized planning criteria for the plant is shown in **Table 11**.

Table 11 – Proposed Planning Criteria for the City of Evans Consolidated WWTP

Parameter	Year 2020			Year 2030			Year 2040		
	AA	MM	PHF	AA	MM	PHF	AA	MM	PHF
Flow Rate (MGD)	2.0	2.4	5.2	2.5	3.0	6.4	3.4	4.1	8.6
BOD ₅ (ppd)	5,578	6,917	-	7,130	8,841	-	9,618	11,926	-
TSS (ppd)	4,985	6,182	-	6,372	7,901	-	8,596	10,658	-
NH ₃ (ppd)	670	905	-	857	1,157	-	1,156	1,561	-
Total P (ppd)	110	149	-	141	190	-	190	256	-

The criteria shown above will be considered the following phase of this planning project, analysis and recommendation of alternatives.

TREATMENT PROCESS CAPACITY EVALUATION

To determine which processes will need to be upgraded to accommodate projected 2040 flow and loading estimates, the 2015 design criteria for each unit process was compared to the new projections. The design criteria are included in the 2015 Wastewater Treatment Plant Process Design Report (Dewberry, 2015). **Table 12** details the current capacities for each process and the required capacities for 2040.

Table 12 – Treatment Plant Unit Process Evaluation, 2015 Design Capacity vs. 2040 Projection

Process Design Parameter (units)	Design Capacity ¹	CDPHE Design Criteria	2040 Projection
<i>Mechanical Screening and Washer Equipment</i>			
Hydraulic capacity, each (MGD)	5.86	PHF	8.58
<i>Grit Equipment</i>			
Hydraulic capacity, each (MGD)	5.86	PHF	8.58
<i>Flow Measurement Equipment</i>			
Hydraulic capacity (MGD)	6	PHF	8.58
<i>Influent Lift Station</i>			
Firm capacity w/ largest pump out (MGD)	5.88	PHF	8.58
<i>Secondary Process (aeration basin, process pumps and secondary clarifiers)</i>			
Average day flow rate (MGD)	2.26	-	3.43
Max month flow rate (MGD)	2.88	-	4.08
Max month BOD ₅ load (ppd)	6,624	-	11,926
<i>Process Air Flow</i>			
Max month BOD ₅ load (ppd)	6,624	-	11,926
<i>Alum Chemical Feed System</i>			
Chemical dose (mg/L)	96	-	48
Number of days of storage (days)	14	CDPHE	14+
<i>UV Disinfection System</i>			
Hydraulic capacity per channel (MGD)	5.86	PHF	8.58
<i>Effluent Flow Measurement Equipment</i>			
Hydraulic capacity (MGD)	10.41	PHF	8.58
<i>Anaerobic Sludge Lagoons</i>			
Hydraulic capacity (MGD)	2.88	MMF	4.08

¹ From Wastewater Treatment Plant Process Design Report (Dewberry, 2015)

As shown, most liquid stream processes do not currently meet the projected 2040 capacities, except for the effluent flow measurement equipment. A discussion of costs and evaluation of the treatment infrastructure needed to accommodate the Year 2040 projected flows and loads will be discussed in a future technical memorandum.

CONCLUSIONS AND RECOMMENDATIONS

This memorandum finds that the hydraulic capacity for all liquid stream unit processes, except for alum storage and effluent flow measurement equipment, are insufficient to meet the 2040 peak hourly flow rate of 8.6 MGD. In addition, two plant processes, the secondary process and process air flow, are designed for a lower BOD loading rate than the projected 11,900 pounds per day (ppd) for year 2040. Dewberry will recommend unit process upgrades to meet the projected conditions in a succeeding memorandum to the City of Evans. The following is a summary of the projected, recommended improvements to the liquid stream and solids handling processes:

1. Headworks
 - a. Mechanical Screening: Insufficient hydraulic capacity to accommodate projected 2040 PHF. Add a second mechanical screen to available channel.
 - b. Grit Screening: Insufficient hydraulic capacity to accommodate projected 2040 PHF. Add a second grit screening and washing process north of GCC 1201.
 - c. Lift Station: Insufficient hydraulic capacity to accommodate projected 2040 PHF. Increase capacity by adding a third wet well chamber and upgrading pump operation to 6 pumps (5 duty, 1 standby) to meet 9 MGD.
2. Secondary Process
 - a. Johannesburg Process: Insufficient treatment capacity 2040 BOD₅ and ammonia loads. Will need to increase secondary process treatment capacity by adding additional Johannesburg process trains or incorporating Biomag (a process intensification process)
 - b. Secondary Process Pump Station:
 - i. Process Pumps (RAS, WAS) – Insufficient capacity to meet 2040 flows. Incorporate additional process pumps and/or building space to accommodate future secondary process requirements.
 - ii. Blowers – Insufficient capacity to meet projected 2040 loads. Incorporate additional blower in the available space.
 - iii. Construct new scum pump station. Scum currently flows by gravity to the anaerobic sludge lagoons
 - c. Secondary Clarifiers – Insufficient capacity to meet projected 2040 flows and loads. Either incorporate additional secondary clarifiers or upgrade to Biomag (process intensification process).
3. Disinfection and Effluent System
 - a. UV Disinfection Insufficient hydraulic capacity to accommodate 2040 flows. Add modules to channel UVG 7003.
4. Solids Handling – Anaerobic sludge lagoons have insufficient capacity to accommodate 2040 loads.

- a. Incorporate WAS thickening and biosolids dewatering.
- b. Incorporate aerobic digestion or ATAD (AutoThermal Thermophilic Aerobic Digestion).

REFERENCES

Dewberry. (2015). *Consolidated Wastewater Treatment Plant Needs Assessment*. City of Evans.

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